The Heated Vacuum Drying System was assembled to provide a process for drying the fuel debris from the Three Mile Island Unit 2 (TMI-2) accident. This material has been stored underwater since the accident in a fuel storage basin at INEEL's Test Area North. Although supplied by a commercial vendor, the system is unique and specially designed and constructed for this task.

Spent fuel from commercial power plants is moved from wet to dry storage using a process in which the fuel elements are placed into a large canister, which is purged of water, and then dried by pulling a high vacuum on the sealed canister. In the vacuum (2 to 5 torr), the vapor pressure is so low that essentially all water is vaporized and removed.

As noted in its title, the INEEL system is heated. Vacuum drying of comparable commercial fuel is assisted by decay heat from the spent fuel. Decay heat keeps water in the liquid form, allowing direct vaporization when the vapor pressure drops. Vacuum drying in the absence of heat can result in freezing of large quantities of retained water, since the removal of the air in the canister results in a large heat loss for the system. Sublimation of the frozen water progresses much more slowly, increasing process time and reducing certainty that adequate dryness has been achieved. The TMI-2 core had little burnup at the time of the accident, and thus little decay heat in its present form .

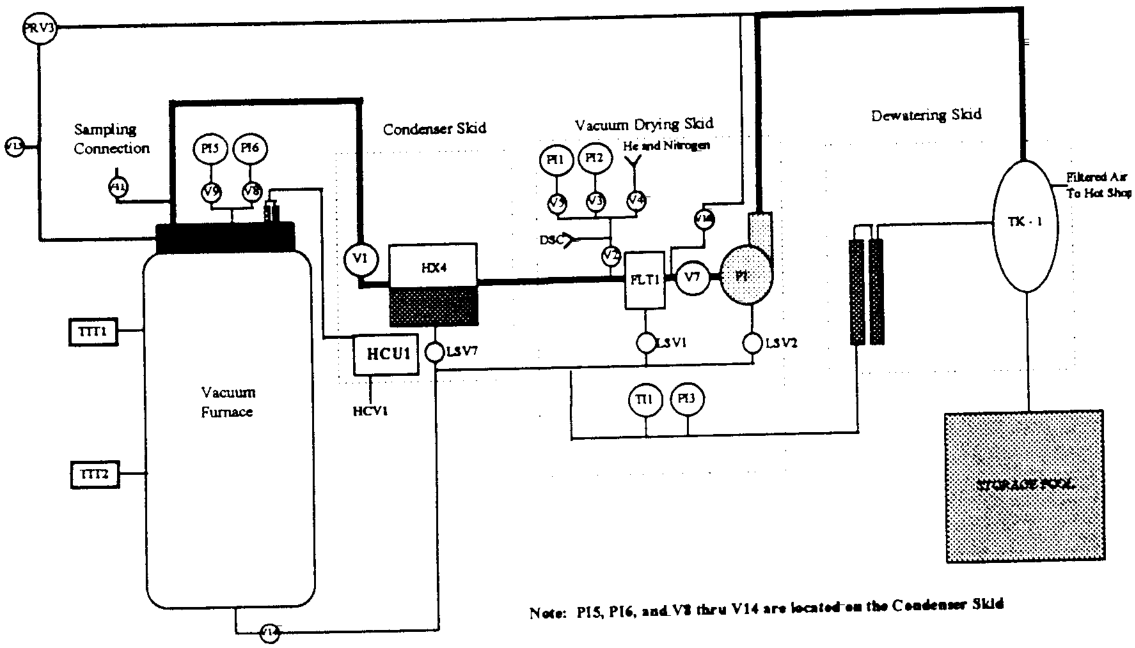
The process used in HVDS is tailored for the TMI-2 fuel. Unlike commercial fuel assemblies, the TMI-2 material is contained in 14 inch OD by 140 inch long stainless steel canisters which are fortified with an internal lightweight concrete structure. These canisters have special remotely operable quick connect lines for purging of water. The canister design includes mesh for trapping particles down to 20 microns to prevent discharge with the water. The debris (knockout) canisters were used in conjunction with filter canisters that removed entrained particles down to 2 microns.

Canisters are placed in groups of four into a specially designed basket inside the vacuum vessel, which is installed inside a spent fuel shipping cask to provide personnel shielding. Canisters are dewatered by pumping out the water through the canister purge lines, with discharge being routed to the complementary filter canister, a second stage 1 micron filter, and ultimately through an ion exchange bed, intended to remove dissolved cesium and other radionuclides before being returned to the fuel storage basin.

Following dewatering, heat and vacuum are applied, vacuum to a pump limit of 2 torr, temperature to a process limit of 950 F. This is an oxide fuel and most debris is oxide, reducing concern for volatilization of fission products and damage to cladding caused by high temperatures. Heat is introduced by electrical resistance elements that are attached to the exterior of the vacuum vessel. The result of this drying cycle is a material that is so dry as to adsorb water when exposed to ambient air .

When adequately dried, the canisters are put into a Dry Shielded Canister configured to contain 12 debris canisters. The DSC is of the NUHOMS design produced by the former Nuclear Pacific, Vectra, now Transnuclear West company. Following final welding, the DSC is then put into a Horizontal Storage Module, which is a concrete structural and shield unit that is the second component of the NUHOMS storage design.

Use of this system for any task other than its current mission will require modification of vacuum furnace internals that support the canisters during drying. The drying system will be dedicated to the TMI-2 process exclusively until all of the TMI fuel is stored in DSCs, the deadline for which is 6-1-2001.



Note: PI5, PI6, and V8 thru V14 are located on the Condenser Skid